CHEMICAL ENGINEERING PROGRESS

vol. 51—1955

Editor's Note: Page numbers preceded by the number of the issue (No. 1, No. 3, etc. indicate that the article is in the News Section of that issue.

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RECENT DEVELOPMENTS IN THERMODYNAMICS

R. H. Dodd, Okla. Inst. of Tech.

Three-day Conference under auspices of the chemical engineering department of Oklahoma A & M, tackles subject of Applied Chemical Engineering Thermodynamics, hears three leaders in the field.

To acquaint chemical engineers in industry with recent developments in thermodynamics, and to provide an opportunity for these industry-employed engineers to meet and discuss problems with men who are making significant contributions to the theory and application of chemical engineering thermodynamics. That's why the chemical engineering department at Oklahoma A & M, Stillwater, Okla., brought some 75 industrial chemical engineers to a three-day Conference, Nov. 16-18, invited three outstanding thermodynamic chemical engineers to lead the discussion.

Keynote of the conference was that while industry is making increasing use of chemical engineering thermodynamics as a powerful tool in the solution of chemical engineering problems, the high cost of exploratory research by pilot plant operation makes it highly desirable to use improved methods for prediction and correlation of physical and chemical data.

Leading off, Prof. O. A. Hougen, Univ. of Wisconsin, went deep into the extensive theoretical work being done at Wisconsin by himself, A. L. Lydersen, and R. A. Greenkorn. Already widely published, this work on "Generalized Thermodynamic Properties of Pure Gases and Liquids," (Report No. 4, Engineering Experiment Station, Univ. of Wisconsin, October 1955), deals with, and gives extensive tables for, compressibility factors, reduced densities, vapor pressures and latent heat, fugacity coefficients, equilibrium constants, and deviations from ideal gas behavior for internal energy, enthalpy, and entropy for specific pressures, temperatures and parameter ranges.

Hougen then went on to apply these generalized methods to the solution of industrial problems involving heat and work requirements and state changes encountered in expansion, compression, liquifaction, etc. Particular attention was paid to the limitations of thermodynamic properties and equilibrium constants in equations for industrial reaction rates. Hougen emphasized the empirical nature of reaction rate formulations, and stressed that the term "apparent mechanism" referred only to rate-controlling chemical steps where such could be identified from the studies of extensive experimental data on reaction rates.

Benedict-Webb-Rubin Equation

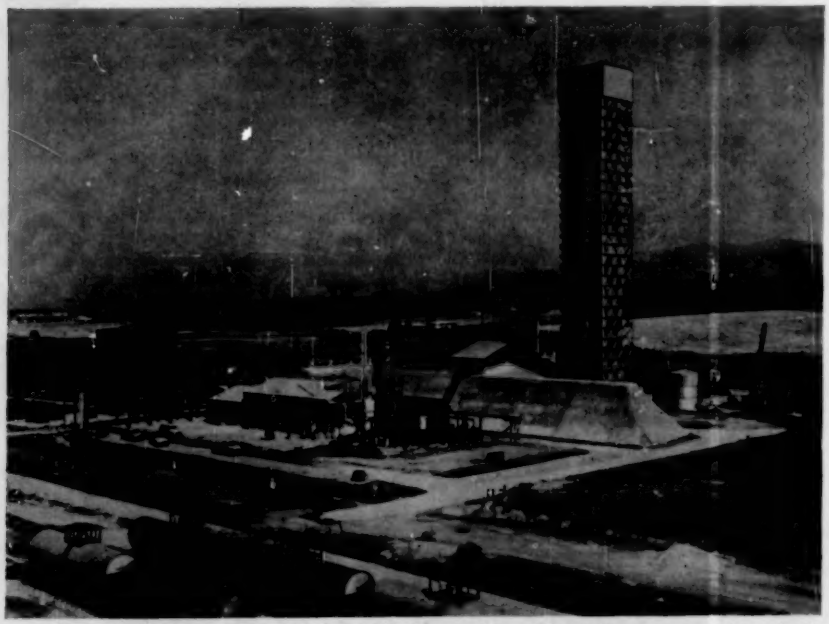
A major point raised in the conference by B. H. Sage, professor of chemical engineering at California Inst. of Technology, concerned the utility of the Benedict-Webb-Rubin equation of state for the prediction of the thermodynamic properties of hydrocarbons and their mixtures.

It appears that the Benedict equation may not describe the volumetric behavior of hydrocarbon mixtures with sufficient accuracy to be effective in predicting the isothermal change of partial enthalpy in the homogeneous regions. Experimental information is still desirable in order to establish the thermodynamic properties of fluids at many of the elevated temperatures required in industrial processes.

Computers Bring Advances

Concentrating his major fire on applied statistical thermodynamics, R. A. Bird, associate professor of chemical engineering at Wisconsin, described the progress made in this field in recent years, particularly in the extensive tables of functions now available for utilizing the results of statistical mechanics. And more advances will soon come with the aid of the new and improved electronic computers.

Finally, Bird pointed to the great use potential for the chemical engineer in the differential equations of continuity, motion, and energy balance. Applications of these equations can be made in the formulation of complex engineering flow problems such as forced convection, free convection, simultaneous heat and mass transfer, and flow with chemical reactions.



Tallest all-aluminum structure in the world features Brea Chemical's new ammonium nitrate fertilizer plant near Brea, Calif. The 200-foot "prilling" tower is 100% aluminum to withstand chemical corrosion. First plant of its type in the West, the new plant of Union Oil's subsidiary company will produce 50,000 tons/yr. □

PUBLICATION OF PAPERS --NEW BY-LAW

A new By-Law of A.I.Ch.E., passed at the Lake Placid meeting after more than a year of study and consideration, reads:

> **"Notice of papers to be presented before other meetings arranged by local sections shall be sent in advance to the Executive Secretary. To afford opportunity for consideration for publication by the Institute, such papers shall not be released for publication until acknowledgment of such notice has been received by the section."**

Purpose of the By-Law is to insure fair access to papers given at local sections, regardless of the geographical location of the various publications, or the representation of a publication's members in the local section. National headquarters will attempt to give prompt acknowledgment, requests immediate notice if any delay is experienced. The By-Law is designed to help the Institute function more efficiently, and does not mean the Institute will publish all papers given at local section meetings. □